Appendix A: Industry Background Information

***Disclaimer*: This draft report was prepared to help the Department of Energy determine the barriers related to the deployment of new nuclear power plants but does not necessarily represent the views or policy of the Department.**

Introduction

- Appendix A and Section 2 summarize results from the industry analysis task. Information from the industry analysis helped in defining the risks associated with nuclear power, identifying the leading executives who participated in the interview process and roundtable discussions, and building the financial model.
- Material in Appendix A introduces the reader to the highlights of the following subjects, which have implications for the future of nuclear power:
  - Market drivers for nuclear power.
  - Electricity consumption by fuel type, 1990 – 2010.
  - Large increase in U.S. electricity capacity forecast by 2020, but none for nuclear energy.
  - Schedule for expiration of licenses for U.S. nuclear power plants.
  - Extensive actual and projected capacity additions for gas-fired plants in the United States through 2004.
  - Extensive construction of nuclear power plants worldwide is underway.
  - U.S. nuclear plant construction companies (EPC firms).
  - Worldwide electricity generation via nuclear power, by country and region.
  - Nuclear generation in the United States, by company.
  - Pattern of consolidation of ownership of nuclear power plants in the United States.
  - The financial performance of nuclear utilities outperformed that of non-nuclear utilities.
  - U.S. transmission capacity and investment in transmission capacity compared with electricity generated.
  - Key dates and developments for operation of transmission grids in the United States.
  - DOE press release about regional transmission bottlenecks.
  - Data on world prices and reserves for uranium fuel.
  - Status update on Yucca Mountain fuel waste disposal repository.
  - R&D expenditures for nuclear power, worldwide.
  - Status of nuclear engineering training and research reactors in the United States.

Some Market Drivers Favor Nuclear Power

- **Electricity Loads Concentrated in Urban Areas:**
  - High energy density of nuclear power matches urban loads. Most plants are located near urban areas.
  - Ultra-low -emissions of nuclear power offers relief in urban areas battling air pollution.
- **Better Power Quality**: The high-technology economy creates much higher requirements for "power quality" with no interruptions.
  - Automated machinery, high speed communications, and digital networks require very steady power with less "electronic noise" on a "24/7" basis.
  - Nuclear units offer steady power, insulated from weather changes. In contrast, renewable energy sources, including hydropower, are vulnerable to weather (drought, lack of sunshine, wind conditions).
- **Policy Shift**: The May 2001 National Energy Policy provides new political momentum for nuclear power with impact on market outlook and acceptance:
  - In May 2002, the House of Representatives voted 306 – 117 in favor of proceeding with construction and licensing of the Yucca Mountain repository for nuclear spent fuel.
  - The Senate is expected to do the same by July.
  - NRC is specifying more streamlined procedures for licensing new nuclear plants, including early site permits (ESP), a combined construction and operating license (COL), and acceptance criteria (ITAAC) for approval after construction.
- **Retirement of Baseload**: An aging U.S. coal, hydropower, and nuclear fleet must be upgraded. EIA projects that at least 300 GWe of new plants will be needed by 2020. Other projections run to 400 GWe.
  - Hydropower capacity is about 80 GWe now, but no new hydropower is being built and current dams are silting up, reducing capacity.
  - Demand is rising at 1.8% per year according to EIA.
- **Climate Change**: Elevated interest in environmental sustainability and climate change since the Rio Summit in 1990 has created international pressures to reduce greenhouse gas emissions.
  - *Non-emitting* nuclear power offsets "greenhouse gas" (GHG) emissions from fossil energy.
  - The President endorsed nuclear power as an important element in plans to reduce the "carbon intensity" of the U.S. economy by 2012.
- **Demographic Drivers:** Population growth and urbanization in industrializing countries, particularly in Asia, are creating demand for electricity, which is rising at two to three times underlying economic growth.
  - Urbanization in developing countries matches the high energy density that nuclear power offers; by 2020, the world will likely see 25 cities with more than 10 million people—up from about 12 now.
  - Japan, Korea, Taiwan, and China are all building nuclear plants now. More orders are in the pipeline.

U.S. Electricity Consumption by Fuel Type, 1990 – 2010

- EIA and industry sources forecast that the majority of new generation capacity through 2010—whether baseload, intermediate, or peaking—will be gas. Growth in nuclear power generated has occurred through capacity factor improvement and power upratings.
- Some mine-mouth coal plants (baseload) are also planned, but permitting challenges based on emissions may limit planned growth.
- Percentage growth for electricity from renewable sources (little of it baseload) is projected to be high, but in absolute KWh the largest growth will occur in gas. EIA forecasts that growth in renewables will barely offset the decline projected for hydropower through 2020, as dams silt up and water is needed for irrigation.
- Note that coal, nuclear, and hydro are baseload, as is some gas.

Fuel Source	1990	1995	2000	2005	2010	% Total 2000	% Total 2010	Growth 2000-2010
Coal	1,550	1,730	1,835	2,000	2100	50.4%	48.4%	265
Nuclear	600	660	740	760	780	20.3%	18.0%	40
Gas	260	265	600	800	1000	16.5%	23.0%	400
Oil	100	70	80	82	76	2.2%	1.8%	-4
Hydro	293	311	302	277	263	8.3%	6.1%	-39
Biomass	33	37	40	48	56	1.1%	1.3%	16
Landfill Gas	11	18	20	24	28	0.5%	0.6%	8
Geothermal	16	15	18	21	23	0.5%	0.5%	5
Wind	3	3	4	5	8	0.1%	0.2%	4
Solar PV	0.7	0.8	1	2	4	0.0%	0.1%	3
Fuel cells	0	0	0	1	2	0.0%	0.0%	2
Totals (bil KWh)	2,867	3,110	3,640	4,020	4,340	100.0%	100.0%	700
Growth		8.5%	17.0%	10.4%	8.0%			bil KWh

Source: EIA

EIA Capacity Forecast: 300 GWe to Be Added, But None for Nuclear, by 2020

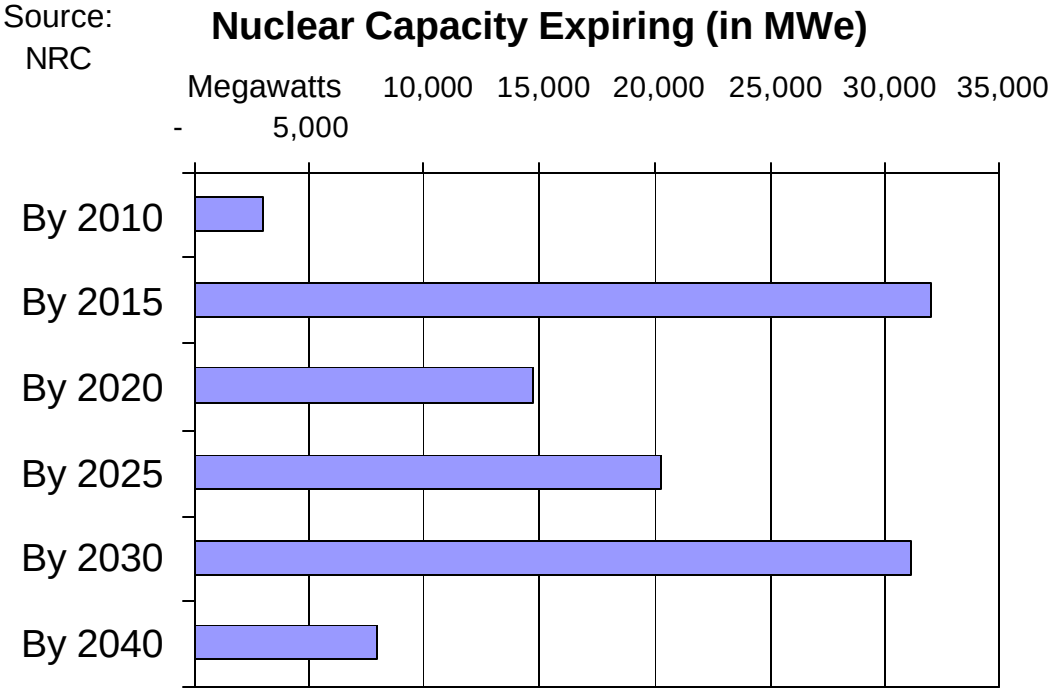
- Current EIA (DOE's Energy Information Administration) projections do not forecast any new nuclear capacity coming on line by 2020—simply because there are no orders today.
- As baseload power—both coal and nuclear—operates at higher capacities than non-baseload sources, baseload plants provide more than 50% of the power. Coal plants comprise 40% of the nation's capacity, while nuclear plants are 12% – 13% of U.S. capacity. Nuclear plants generate 20% of the nation's electricity.
- Hydropower is also geared for baseload, but it is much more subject to weather conditions (e.g., drought) and to competing needs for water. Hydropower is concentrated in certain regions and production is declining.
- As deregulation and market competition unfold in some regions, utilities are shifting some plants to intermediate and peaking units to better match load demand and market conditions. EIA suggests that, by 2020, baseload as a percentage of total capacity will decline.
- Some observers in environmental and regulatory circles have pointed out that proposals to add and relicense coal plants may encounter emissions hurdles that are not assumed in current EIA forecasts.
- In 2000, U.S. CO2 emissions totaled 1.56 billion metric tons, one-third of it from coal-fired power plants. International developments and progress on U.S. climate change policy could lead to the establishment of incentives that alter the capacity projections below.

GWe **Fuel Source**	**2000**	**2005**	**2010**	**2015**	**2020**	Growth 2000-2020	% Total **2000**	% Total **2020**
Coal	304.6	303.7	306.0	313.0	329.0	24.4	40.4%	31.0%
Nuclear	97.5	97.7	94.3	88.8	88.0	-9.5	12.9%	8.3%
CC Gas-fired	165.6	187.0	255.5	296.8	327.1	161.5	22.0%	30.8%
Oil; Dual-fired	78.0	105.0	129.0	149.0	173.5	95.5	10.4%	16.3%
Hydropower	80.0	76.8	73.7	70.8	67.9	-12.1	10.6%	6.4%
RE	27.9	37.9	42.9	49.4	57.7	29.8	3.7%	5.4%
Distributed Gen	0.0	1.0	5.0	11.0	19.0	19.0	0.0%	1.8%
Totals (bil KWh)	753.6	809.1	906.4	978.8	1,062.2	308.6	100.0%	100.0%
Growth		7.4%	12.0%	8.0%	8.5%	GWe		

U.S. Nuclear Capacity Is Scheduled to Expire, 2000 – 2040

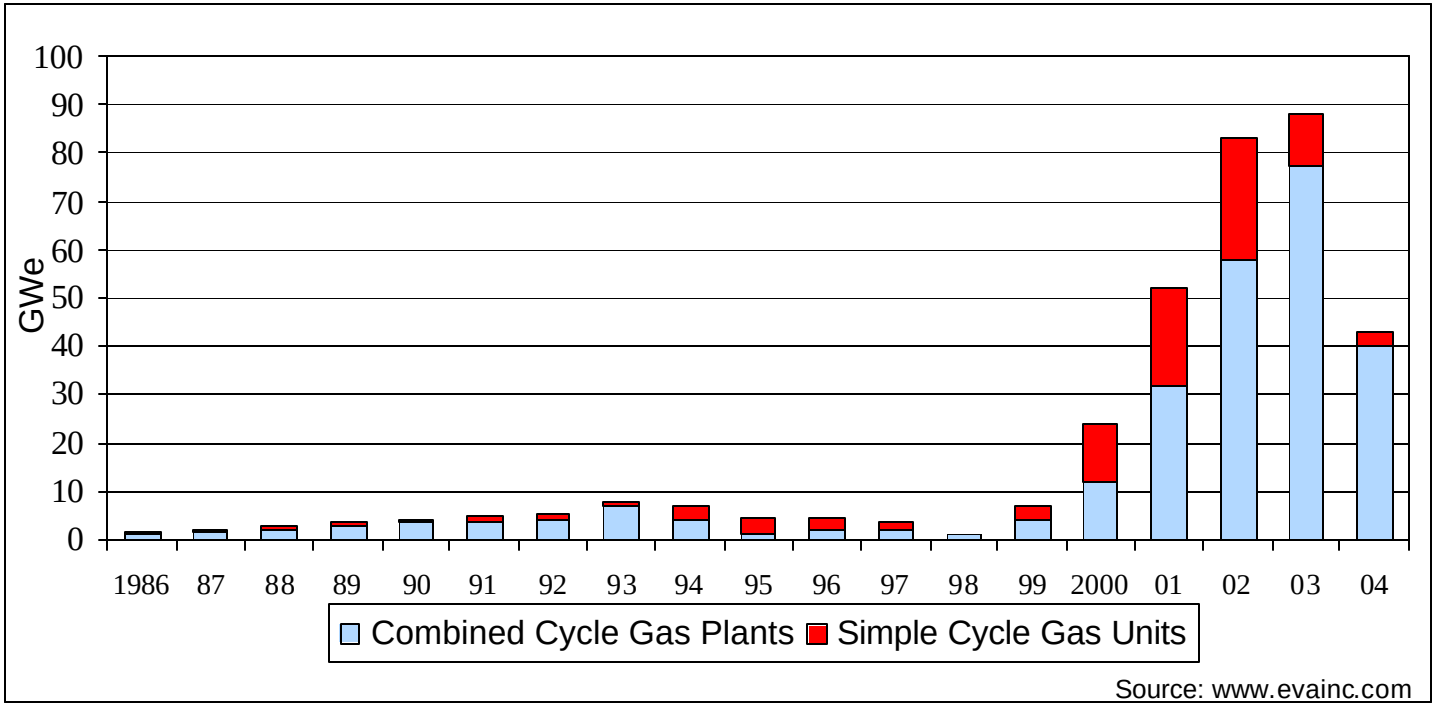
- In light of excellent operating records and the low cost of power produced from U.S. nuclear reactors, >80% of U.S. reactors will likely be proposed for license renewal (for an additional 20 years of service) prior to the expiration of their licenses, according to NRC. Ten years ago, fewer than 20% of licenses were expected to be submitted for renewal.
- Relicensing will improve the competitive position of nuclear operators because existing plants are fully amortized baseload units that carry very low marginal costs for electricity.
- The chart below does *not* reflect the prospective life extensions from relicensing.

Source:
NRC



Gas-Fired Plants Dominate U.S. Power Construction, 1986 – 2004

- The industry analyst, Economic Value Associates, Inc., (evainc.com) projects that >200,000 MWe, or >200 GWe, of gas plants are in planning or design stages or came on line between 1998 and 2004. Although most of these plants are not planned to be baseload, their sheer numbers make them major competition for new nuclear and coal plants.
- In light of temporal over-capacity and an economic slowdown, the construction of many projected gas plants has been deferred and new commitments have slowed.
- A few coal plants have entered planning stages, but they may face permitting hurdles associated with clean air and climate change concerns. All of these plants will be pulverized coal or fluidized bed units; no gasification units are being considered because of high capital costs.



Source: www.evainc.com

Nuclear Plants Are Being Built Outside the United States

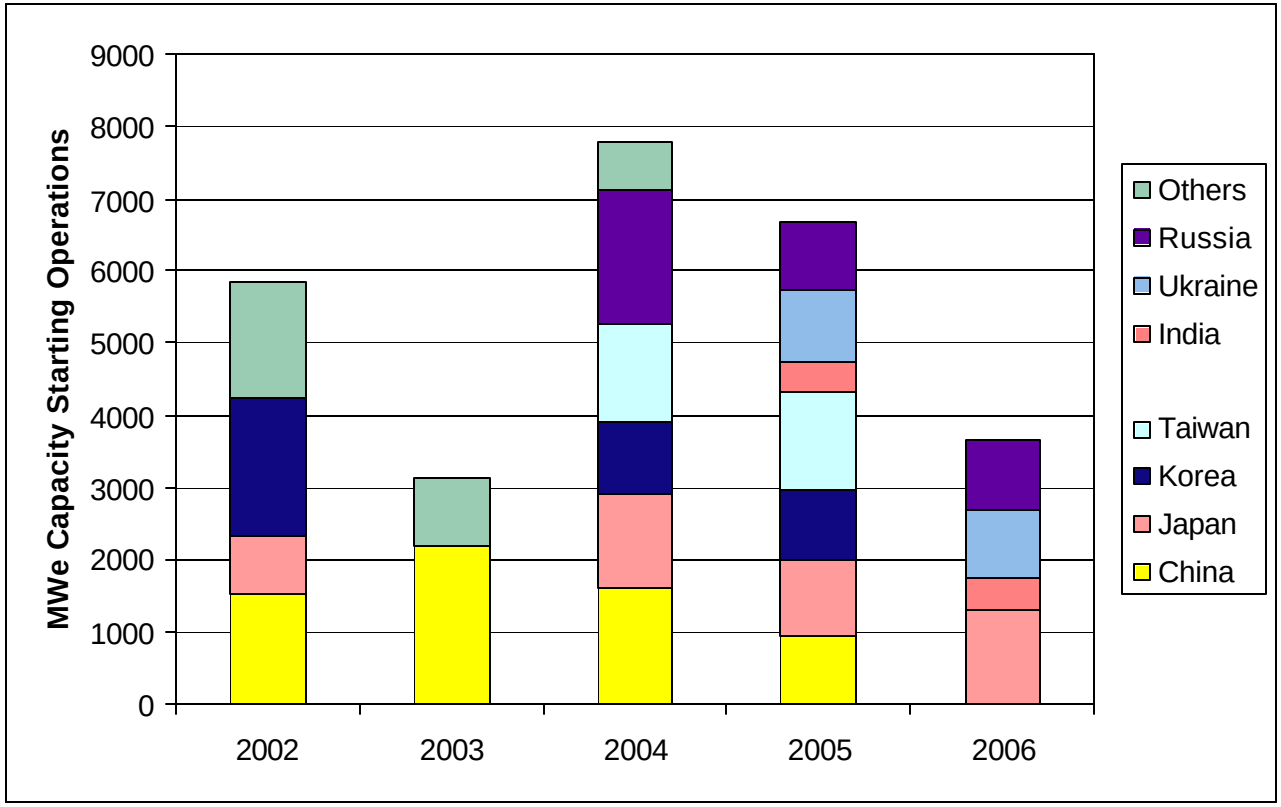
- Thirty-two nuclear plants with a total of 26,410 MWe are being built worldwide.
  - Nearly two-thirds of the current construction activity (by MWe) is in Asia.
  - Russia and the former Soviet Union (FSU) account for another 25%, as aging baseload plants must be replaced. Two reactors were brought on line in 2001: Onagawa 3 (800 MWe BWR) and Rostov 1 (950 MWe WWER).
- Japan is planning another 10,000 MWe after 2006 that will raise nuclear generation capacity to 45% of that nation's total, up from 35%. Construction recently started on Shika 2 in Japan, an ABWR unit.
- Korea is also planning more reactors, and two units are under construction in Taiwan.
- China has eight reactors at varying stages of progress.
- The next slide contains a bar chart of new plants under construction worldwide.

Country	2002	2003	2004	2005	2006	Total	% Total
China	1,545	2,210	1,615	950		6,320	23.9%
Japan	796		1,325	1,067	1,315	4,503	17.1%
Korea	1,900		950	950		3,800	14.4%
Taiwan			1,350	1,350		2,700	10.2%
India				450	450	900	3.4%
Ukraine				950	950	1,900	7.2%
Russia			1,875	950	950	3,775	14.3%
Others	912	950	650			2,512	9.5%
Totals (MWe)	5,153	3,160	7,765	6,667	3,665	26,410	100.0%

Source: World Nuclear Association / www.world-nuclear.com

Nuclear Reactors Under Construction in Asia and FSU, 2001 – 2006

Most of the reactor construction underway is in Asia and the Former Soviet Union (FSU).



Source: Uranium Info Centre (http://www.uic.com.au/nip19.htm)

Nuclear Plant Construction Capacity is Global; U.S. Experience Is Concentrated in a Few E&C Firms

- Bechtel designed and/or constructed 40 of the 103 U.S. nuclear plants now on line.
- Sargent & Lundy is active in Asia, and Black & Veatch is emerging as a possible player in the United States.
- Stone & Webster, now operating under Shaw, could also respond to new orders.
- However, U.S. firms continue to face aging of their nuclear engineering workforce and management, while university nuclear engineering departments in the United States have declined.
- Primary competition arises from large foreign companies currently building nuclear plants in Asia (i.e., Mitsubishi, Hitachi, Toshiba, Korea Electric).
- The French company Framatome ANP, which has 2000 employees in the United States, is another strong competitor. Framatome ANP acquired divisions of Duke Engineering in 2002, deepening its already strong U.S. position in the nuclear services market.

U.S. E&C Firm	Utility Clients (Reactors)	Units*
Bechtel	PECO (Exelon), Southern, PPL, FP&L, CEG, PSEG, NSP, AZPS	40
Sargent & Lundy	UniCom (Exelon)	12
Stone & Webster (bought out of bankruptcy in 2000 by Shaw Group)	NYPA, FirstEnergy	10
UE&C	CP&L (Progress), NYPA, PSEG	10
Duke Engineering (bought by Framatome in 2002)	Duke Power	7
Ebasco (bought by RUST, then merged into Washington Group)	FP&L, VT Yankee	6
Burns & Roe	NJ GPU, Nebraska	4
Others	Local or State Utilities	6
TOTALs		**94**
TVA	TVA (Federal Government)	9

Source: ANS, Nuclear News, March 2002

Nuclear Generation Worldwide: Asia Surges; North America Remains Even

- Despite record North American nuclear power generation in 2000 of 823 billion KWhs, North America's share of worldwide nuclear generation stayed roughly even.
- Asian countries, led by Japan, are building more reactors, so nuclear's share of generation will rise on that continent.
- Planners in the Former Soviet Union, principally Russia and the Ukraine, intend to expand nuclear power production as economic recovery slowly takes hold.
- The contribution of nuclear energy to electricity generation in Western Europe continues to decline, except in France, as nuclear power faces moratoriums and phase-outs. Legislation curtailing nuclear power has been passed in Italy, Belgium, and Germany.

Source: EIA

Country / Region	1980	1985	1990	1995	2000	Change 1980-2000	1990 %Total	2000 %Total
United States	251	384	577	673	754	503	30.3%	31.0%
Canada	36	57	70	93	69	33	3.7%	2.8%
Russia, E.Europe	83	200	251	224	265	182	13.2%	10.9%
France	63	211	298	358	394	331	15.6%	16.2%
Germany	44	126	140	145	161	117	7.3%	6.6%
U.K.	32	54	59	81	82	50	3.1%	3.4%
Rest of Europe	80	181	210	209	213	133	11.0%	8.8%
W. Europe	219	572	707	793	850	631	37.1%	34.9%
Japan	79	150	192	277	294	215	10.1%	12.1%
Korea	3	16	50	64	103	100	2.6%	4.2%
Taiwan	8	28	31	34	37	29	1.6%	1.5%
Other Asia	3	4	7	19	31	28	0.4%	1.3%
Asia	93	198	280	394	465	372	14.7%	19.1%
Rest of World	2	14	20	29	31	29	1.0%	1.3%
World Total	684	1,425	1,905	2,206	2,434	1,750	100.0%	100.0%

Top Operators Lead Nuclear Power in Higher Generation

- Consolidation of the nuclear industry during the last three years shows in generation data, as the top thirteen operators continue to increase their market shares of nuclear generation (in billion KWh) by buying up existing assets.
- While these twelve utilities, plus TVA, provide >35% of U.S. electric consumption, they now provide >75% of the annual volume of nuclear generated power.
- Strategically, most of the utilities are fully integrated; they own coal, gas, and other assets, as well as distribution lines and even gas and fuel properties.
- The proportion of nuclear in the respective portfolios of generating assets reflects different strategies in different regions and varying competitive and regulatory profiles. This finding highlights regional variation among electricity providers.

	Total Generation			Nuclear Generation			Nuclear %
Nuclear Operator	**1999**	**2000**	**2001**	**1999**	**2000**	**2001**	**2001**
Exelon	119	125	131	113	119	124	95%
Entergy	134	131	148	60	59	76	51%
Duke Energy	98	104	114	55	57	60	53%
Southern Company	201	211	228	44	45	50	22%
TVA	141	145	161	43	44	49	30%
Progress Energy	89	92	95	32	34	34	35%
Nuclear Management Co.	34	35	32	34	35	32	100%
FirstEnergy	68	70	72	28	29	31	43%
Public Service Enterprise Grp	32	33	38	24	24	28	73%
Dominion	71	75	74	28	28	27	37%
FPL Group	80	83	96	26	26	27	29%
Constellation Energy Group	43	42	45	26	26	26	57%
TXU Corporation	95	97	94	17	18	20	21%
"Big Nuclear Operators"	1,204	1,242	1,328	529	544	584	44%
U.S. Total (billion KWh)	3,704	3,780	3,850	728	753	768	20%
"Big Operators": % Total U.S.	33%	33%	35%	73%	72%	76%	

Source: NEI, www.hoovers.com

Ownership of U.S. Nuclear Plants Is Consolidating in Strong Hands

- Consolidation of the current nuclear fleet under the management of fewer utilities has improved overall technical and financial performance. The larger owners, now with 75% of U.S. capacity, are able to manage a portfolio of units. They can consider financing new units based on a larger balance sheet of total asset value.

Date Done	*Buyer*	*Seller / Acquired / Merged*	*Nuclear Unit*	*Type*	*Year Start*	*MW*	*Trans-action Size*
Jun-99	Entergy	Boston Edison	Pilgrim / MA	BWR	1972	670	NA
Jun-99	Amergen (Exelon + British Energy)	Unicom	Clinton / IL	BWR	1987	930	NA
Jun-99	Amergen (Exelon + British Energy)	GPU	Three-Mile Isle / PA	PWR	1974	790	NA
Mar-00	Entergy	NYPA	Indian Point 3 / NY	PWR	1976	980	A) $967
Mar-00	Entergy	NYPA	Fitzpatrick / NY	BWR	1974	816	A) $967
Jun-00	Amergen (Exelon + British Energy)	GPU	Oyster Creek / NJ	BWR	1969	650	$10
Aug-00	Dominion	Northeast Utilities	Millstone 2 / CN	PWR	1975	858	B) $1,300
Aug-00	Dominion	Northeast Utilities	Millstone 3 / CN	PWR	1986	1150	B) $1,300
Aug-00	Entergy	Yankee Nuclear	Vermont Yankee / VT	BWR	1973	522	$180
Nov-00	Entergy	ConEd	Indian Point 1 & 2 / NY	PWR	1974	957	$602
Dec-00	Constellation	Niagra Mohawk	Nine-Mile Point 1 / NY	BWR	1969	614	C) $815
Dec-00	Constellation	Niagra Mohawk	Nine-Mile Point 2 / NY	BWR	1988	1140	C) $815
Apr-02	Florida Power	NA Energy Srvc	Seabrook	PWR	1990	1150	
	TOTAL		14 Units	7P / 7B	1977	11,227	

Source: NEI

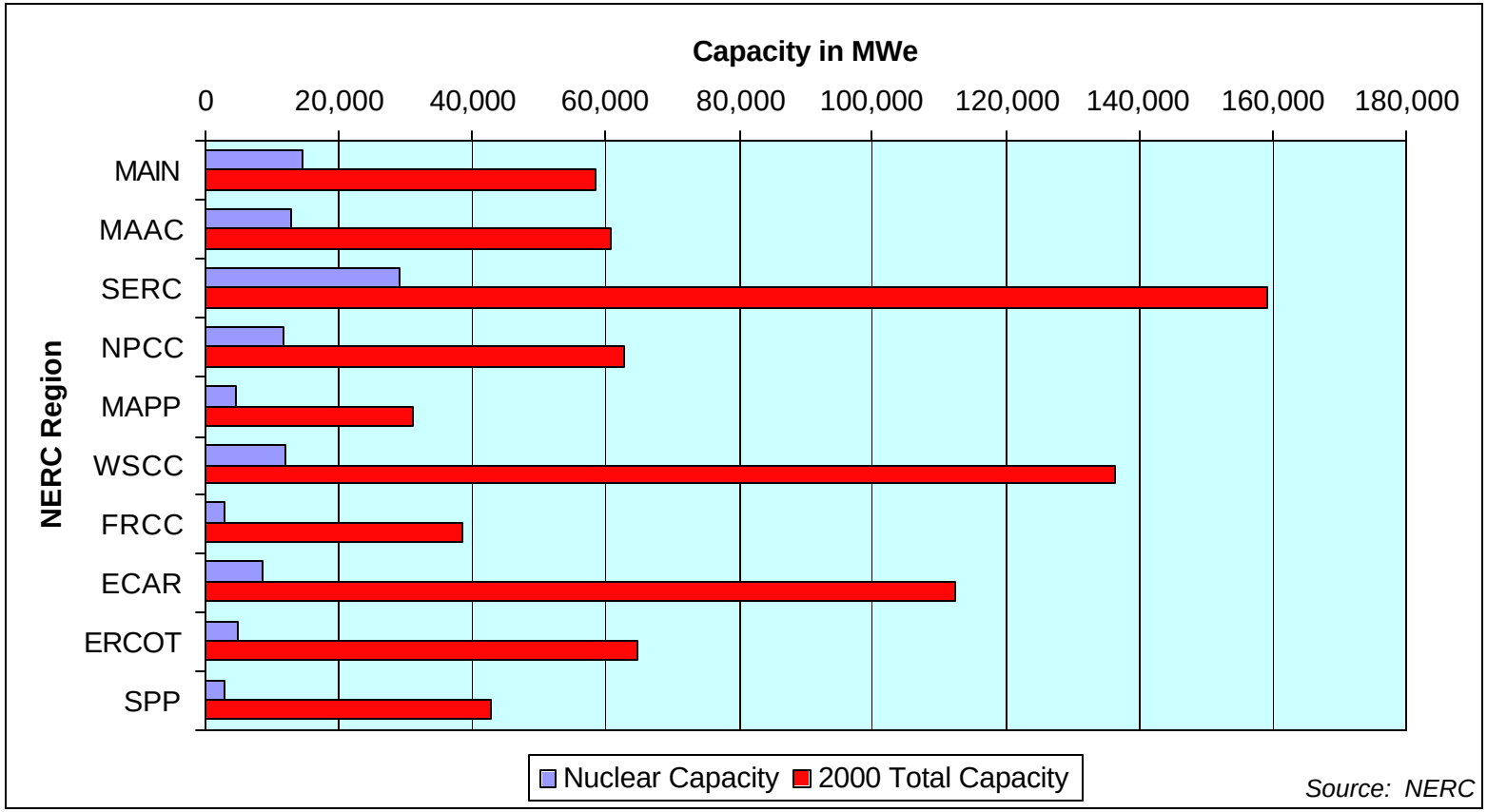
Major U.S. Nuclear Owner / Operators Remain Financially Healthy in 2002

- Nuclear plant ownership is increasingly concentrated. Twelve utilities, plus TVA, now own and operate more than 75% of total nuclear capacity and two-thirds of the reactors.
- Stock prices of nuclear utilities outperformed non-nuclear utilities since January of 2000 through June 2002, and their credit ratings have remained sound.

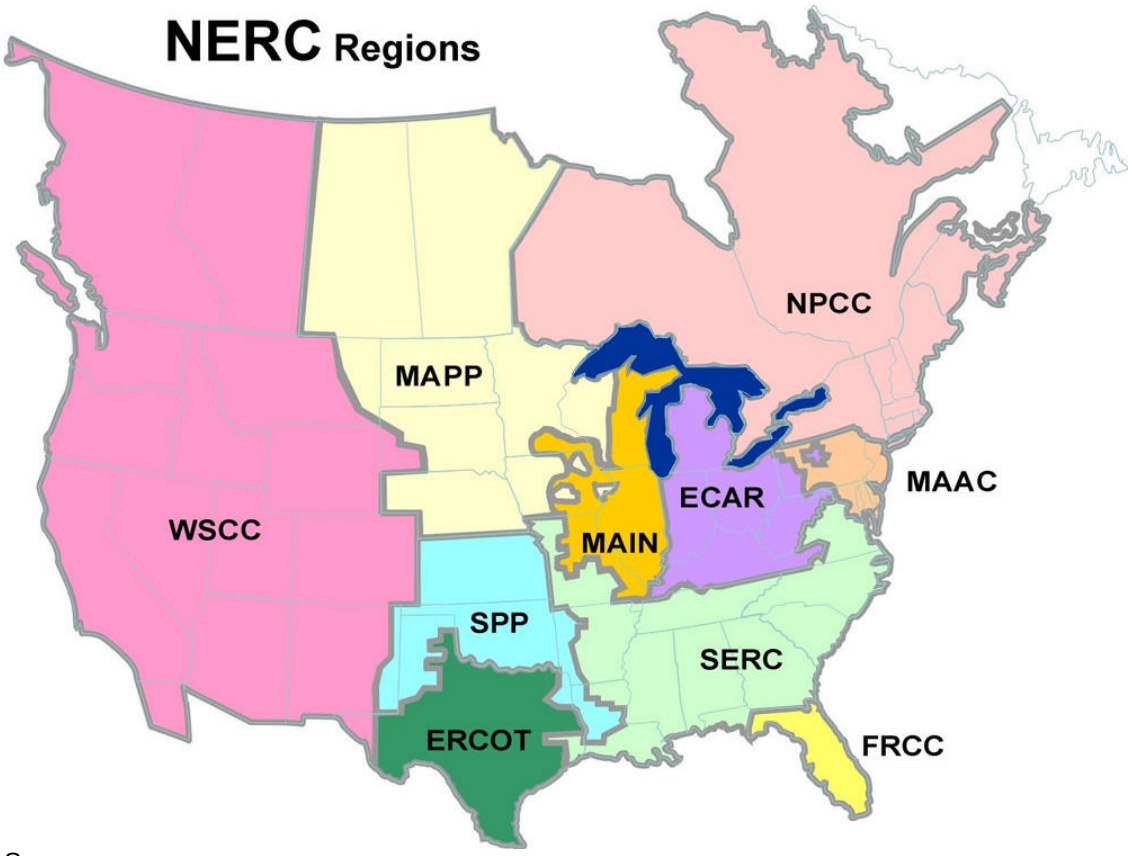
Symbol	(Source: NEI) Nuclear Utility	Region, States	2001 ($B) Revenues	Units PWR / BWR	MWs Nuclear Capacity	Stock Price 1/1/00	Stock Price 7/1/02	Stock Price Change
EXC	Exelon (PECO, Unicom)	PA, IL	$15.10	4P / 10B	14,191	$30	$52	73%
ETR	Entergy Nuclear	LA, AR, MS, NY, MA	$9.60	5P / 4B	8,314	$25	$42	68%
DUK	Duke	SC, NC	$59.50	7P	7,054	$25	$30	20%
PGN	Progress Energy	SC, FL	$8.40	6P / 2B	6,220	$30	$51	70%
SO	Southern Nuclear	GA, AB	$10.20	4P / 2B	5,659	$15	$27	80%
	TVA	TN, MS, AB	$7.00	3P / 2B	5,635	Gov't	Gov't	
D	Dominion Generation	VA, CN	$10.50	6P	5,405	$40	$66	65%
XEL	Nuclear Mgmt Co.	WS, MN, MI, IA	$15.00	5P / 2B	4,353	$21	$17	-19%
FE	First Energy	PA, OH	$8.00	3P / 1B	3,726	$25	$33	32%
CEG	Constellation Nuclear	MD, NY	$3.90	2P/2B	3,363	$30	$28	-7%
FPL	Florida Power Group	FL, NH	$8.47	4P	3,306	$42	$59	40%
PEG	PSEG Nuclear	NJ	$9.80	1P / 2B	3,243	$35	$43	23%
TXU	Texas Utilities	TX	$27.90	2P	2,310	$35	$51	46%
	S&P 500 Index					1,470	990	-33%
	Subtotal		**$193.37**	**40P / 25B**	**72,779**			
	Others		$billions	38 units	23,481			
	Nuclear Total (NEI)			103 units	96,260			

Regional Differences in Nuclear Capacity

- While the southeastern United States has the most nuclear capacity, nuclear power supplies a higher proportion of electricity in the northern middle of America (MAIN, MAAC).
- To illustrate, the Chicago metropolitan area relies on nuclear for 50% of its electricity.



NERC Regions Include Canada (North American Electric Reliability Council)



Source: www.nerc.com

R:DOE-NE:Graphics:040802_NERC Regions.ppt

- Although most consumers and voters are not aware of these facts, the United States does not have a national grid and the U.S. grid is integrated with Canada. NERC coordinates power delivery and reliability within and between ten regional grids in North America (Alaska, Hawaii, and Mexico excluded).
- Three major NERC regions include Canadian provinces that also provide power to the United States.
- Regional grid operations also provide some insulation from a nationwide power shutdown.
- Hence, regional developments in Canada, beyond gas supply, have an impact in planning for U.S. electric capacity. For example, power from nuclear units built in Canada (e.g., CANDU reactors) could be "wheeled" into the United States, as hydropower now is in the NPCC region.

Nuclear Capacity and Trends by NERC Region (United States and Canada)

- Nuclear power plants provide 20% of the nation's electricity (2,928 billion KWh), even though they have only 13.5% of the nation's total capacity (767,500 MWe).
- The reliance on nuclear power varies by region of the country, from 7% to 25%, and is even higher in some metropolitan areas (e.g., Chicago, Baltimore).
- Regional population and urban growth trends also vary widely, so different demand drivers for adding new power plant capacity operate in each region.
- The status of electricity deregulation varies widely by region, as shown on the next page. Many states and regions are not deregulating and have no plans to do so.
- The regional grids under the North American Electric Reliability Council (NERC) include Canada, which operates 10,000 MWe of nuclear power (CANDU units) and is contemplating building more units. So, planning for new electricity generation capacity must be addressed regionally, including Canada. (Note that more CANDU reactors are being built overseas, potentially reducing the outlook for their construction cost in North America.)

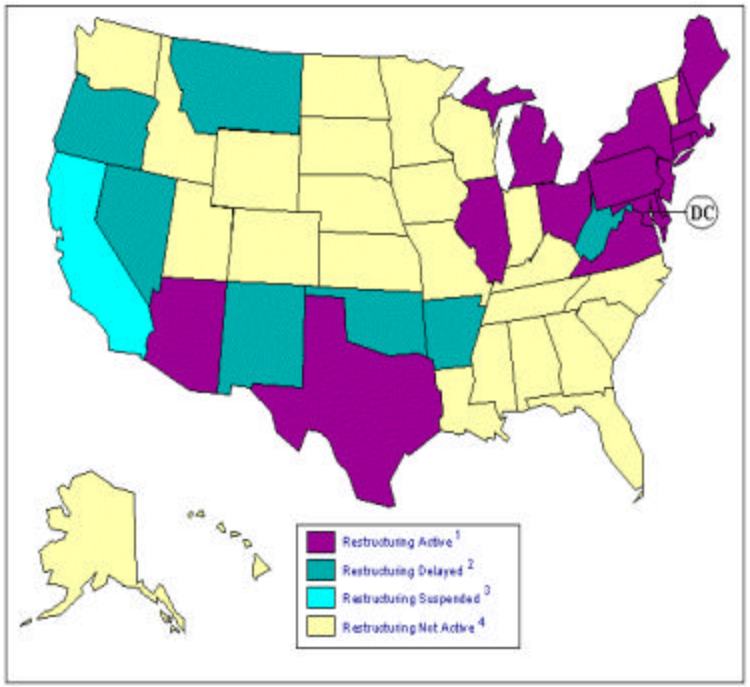
		MWe	MWe			billion KWh
NERC Region (HQ) U.S. & Canada	**NERC**	**Nuclear Capacity**	**2000 Total Capacity**	**Capacity Nuclear %**	**(Million) Pop'n**	**Power Generated**
Mid-American (IL)	MAIN	14,475	58,600	24.7%	21	259
Mid-Atlantic Area (PA)	MAAC	12,796	60,700	21.1%	23	234
Southeastern (GA)	SERC	29,103	159,400	18.3%	45	801
New England (NY)+ E.Canada	NPCC	11,483	62,900	18.3%	51	102
Mid-Continent (MN)+ SK, MB	MAPP	4,439	31,200	14.2%	12	166
Western (CO) + BC, AB	WSCC	11,749	136,500	8.6%	65	178
Florida (FL)	FRCC	3,046	38,500	7.9%	15	158
East Central (OH)	ECAR	8,707	112,200	7.8%	36	590
Texas (TX)	ERCOT	4,800	64,800	7.4%	18	256
Southwest (AR)	SPP	2,932	42,700	6.9%	18	184
U.S. + Canada	U.S.	103,530	767,500	13.5%	304	2,928

www.nerc.com

Restructuring, Deregulation Activity Varies Widely by State and Region

- Restructuring and deregulation involve separating power generation from power distribution to create competition. However, these processes create uncertainty in planning for new baseload power plants.
- Restructuring and deregulation are focused in certain states and NERC regions, particularly New England (NPCC), except in VT, and MAAC, plus the "Rust Belt" industrial states (IL, MI, OH, PA) in ECAR, and MAIN. Deregulation continues in Texas (ERCOT) and NM.
- Restructuring has been limited in the Southeast (SERC, FPCC, SPP) and in the Plains states (MAPP).
- Restructuring has been suspended or delayed in much of the West (WSCC) and in California.

Status of State Electric Industry Restructuring Activity Map

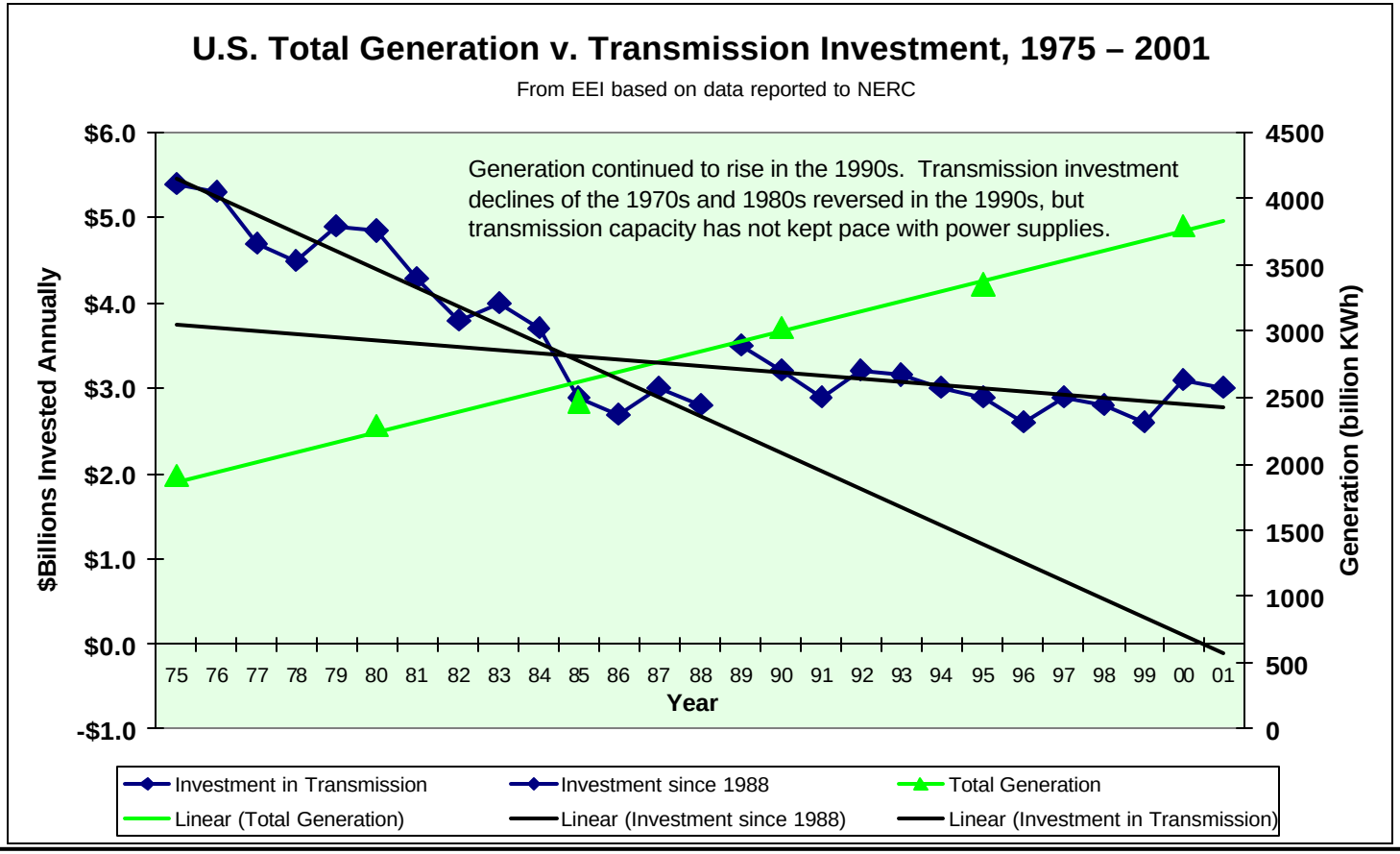


Retail Access: Twenty-four states and the District of Columbia have either enacted enabling legislation or issued a regulatory order to implement retail access. Retail access programs are a primary tool for creating competition in power distribution. In retail access programs, the local distribution company continues to provide transmission and distribution (delivery of energy) services. Retail access allows customers to choose their own supplier of generation services. Retail access schedules vary state by state according to the terms of legislative mandates or regulatory orders. The information in the adjacent "Status of State Electric Industry Restructuring Activity Map" was gathered from state public utility commissions, state legislatures, and utility company web pages.

Source: EIA, May 2002

U.S. Transmission Capacity Fails to Keep Pace, 1975 – 2001

- Investment in transmission capacity continues to decline while total generation steadily rises. Annual transmission investment declined 50% between 1975 and 1988, and it declined by 10% from 1988 to 2000. Meanwhile, total generation in the country doubled from 1975 to 2000.
- FERC is working with states and utilities to define rules for Regional Transmission Organizations (RTOs), including rules affecting ownership, tariffs, and real-time information. But, transmission constraints in some regions remain a threat to orders for new nuclear units.



Key Dates and Developments for Operation of Electricity Transmission Grids

Electric Power Regulation of Transmission

- The Federal Energy Regulatory Commission (FERC) approves rates for wholesale electric sales of electricity and transmission in interstate commerce for private utilities, power marketers, power pools, power exchanges, and independent system operators. The Commission acts under the legal authority of the Federal Power Act (FPA) of 1935, the Public Utility Regulatory Policies Act (PURPA), and the Energy Policy Act (EPAct).
- The Commission oversees the issuance of certain stock and debt securities, assumption of obligations and liabilities, and mergers. The Commission reviews the holding of officer and director positions for top officials in utilities and certain other firms they do business with.
- Finally, the Commission reviews rates set by the federal power marketing administrations, such as the Bonneville Power Administration, confers exempt wholesale generator status under the EPAct, and certifies qualifying small power production and cogeneration facilities.

Source: www.ferc.gov

Key Date	Development
April '96	Start of electricity deregulation by FERC
	Rule 888 Open Access for bulk, wholesale power (Specified in 18CFR35)
	Rule 889 "OASIS" specified: Open Access Simultaneous Information System
	– Over 400 groups commented on orders
May '99	Notice of Proposed Rulemaking on Regional Transmission Organizations (RTOs)
Dec. '99	Rule 2000 for 4 RTOs:
	– West, Midwest, Southeast, Northeast
Jan. '01	Utilities required to file voluntary RTO plans for state and stakeholder review
	Planning, debate, and rulings by FERC on implementation of RTOs
2003	Future rulemaking on RTOs and Market Design

DOE Grid Study Addresses Regional Transmission Bottlenecks, May 2002

Release Date: May 8, 2002

Energy Secretary Abraham Announces Recommendations to Modernize the Nation's Electric Transmission System

National Transmission Grid Study Released

WASHINGTON, DC – Secretary of Energy Spencer Abraham today recommended ways to facilitate investment in the Nation's transmission infrastructure to improve reliability and reduce electricity costs to consumers.

The recommendations contained in the National Transmission Grid Study were developed in response to the President's National Energy Policy directive to Secretary Abraham to study the Nation's transmission system, identify transmission bottlenecks and identify measures to eliminate those bottlenecks.

"Our objective is simple: to provide our citizens with a reliable supply of electricity at the lowest possible cost," Secretary Abraham said in remarks before the Secretary of Energy Advisory Board (SEAB) public meeting on Wednesday afternoon. "We will work to unleash innovation and strengthen our markets to allow entrepreneurs to develop a more advanced and robust transmission system that meets growing energy demand in the years ahead."

Over the past 10 years, competition has been introduced into wholesale electricity markets with the goal of reducing costs to consumers. Today, wholesale electricity sales save consumers nearly $13 billion annually.

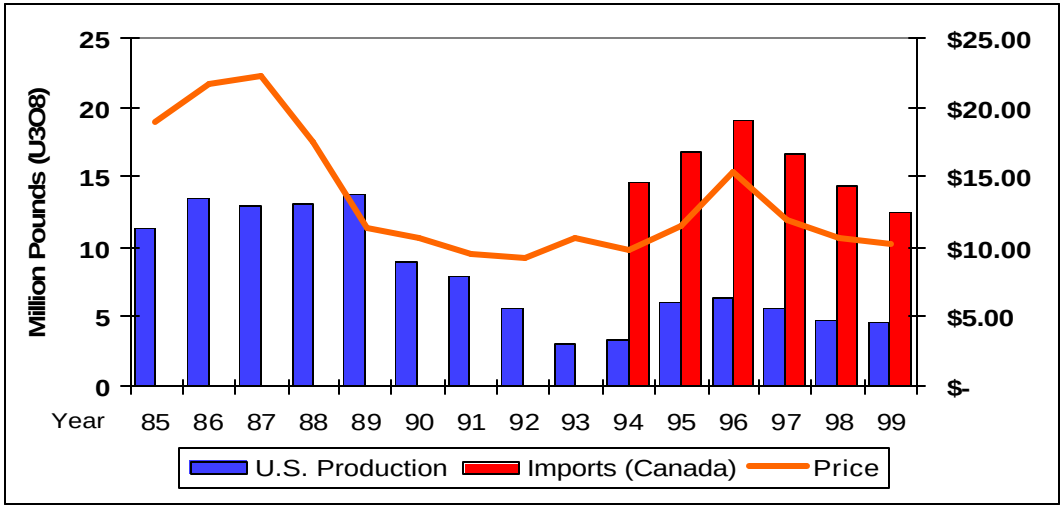
However, the Nation's outdated transmission system was not designed to support today's regional, competitive electricity markets. Investment in the transmission system has not kept pace with the growth in generation and the increasing demand for electricity. Transmission bottlenecks threaten reliability and cost consumers hundreds of millions of dollars each year.

The National Transmission Grid Study contains 51 specific recommendations including:

- In an open public process, DOE will assess the nation's electricity system every two years to identify national-interest transmission bottlenecks.
- Regional Transmission Organizations (RTOs) should be responsible for maintaining the reliability of the grid and ensuring that transmission bottlenecks are addressed.
- DOE will work with the Federal Energy Regulatory Commission (FERC) and stakeholders to develop objective standards for evaluating the performance of RTOs and will collect the information necessary for this assessment.
- DOE will work with National Governors Association (NGA), regional governors' associations, National Association of Regulatory Utility Commissioners (NARUC), and other appropriate state-based organizations to promote innovative methods for recovering the costs of new transmission-related investments. These methods should consider situations where rate freezes are in effect and also examine incentive regulation approaches that reward transmission investments in proportion to the improvements they provide to the system.

Western Uranium Fuel Reserves Are Healthy

- Sharply higher production from Australia and imports from Canada bolster U.S. supplies from stable allies, enabling utilities to cost-effectively maintain continuous supplies and some fuel inventories to avoid fuel outages.
- Global mine production in 2001 topped 35,500 tons of uranium, up 2% from 2000. Reactors worldwide used 64,000 tons of uranium in 2001, according to UIC, fed from utility stockpiles and current production. More mines and production can be brought on line (over a two-year period), if more reactors are ordered.
- Prices for uranium fuel have been lower and more stable than gas prices in the 1990s. Prices declined as the Russian blend-down program of weapons-grade uranium brought more supply to market via USEC's facilities. Blend-down programs displace about 10,000 metric tons of mining production each year.
- Current global feasible reserves of 3 million tons represent a 50-year supply of uranium at current usage. Estimates of total uranium reserves total 15 million tons.



Source: Converdyn (June 2001)

Uranium Reserves, 2001

(economic at <$80/Kg)

Country	M Tons U	%World
Australia	863,000	28%
Canada	433,000	14%
Brazil	197,000	6%
USA	106,000	3%
Western total	**1,599,000**	**51%**
Kazakhstan	474,000	15%
Russian Fed.	133,000	4%
Uzbekistan	106,000	3%
South Africa	300,000	10%
Namibia	240,000	8%
World total	3,111,000	100%

Source: Uranium Information Centre www.uic.com.au

Update on the Status of the Disposal Repository at Yucca Mountain, NV

Timeline	Key Step
1982 – 2001	Scientific studies and site specification, with special attention to groundwater migration.
Dec. '01	Secretary of Energy recommends proceeding on application to NRC.
Feb. '02	President Bush authorizes DOE to proceed.
Apr. '02	Governor Quinn of Nevada vetoes Yucca Mountain project. (Simple majority in Congress needed to override.)
Apr. '02	House Energy & Commerce Committee clears override bill on 41– 6 bipartisan vote.
May '02	Override bill passes in House of Representatives: 306 – 117.
May '02	Final hearings in Senate.
July '02	Override bill passes in Senate 60-39 , overturning veto of Nevada governor.
2002-12?	10- to 12-year process of construction, permit application to NRC, technical and regulatory review, and legal tests.

Secretary of Energy Spencer Abraham, relying on more than 20 years and $4 billion in scientific studies that demonstrate Yucca Mountain is scientifically and technically suitable for development, recommended to President Bush on February 14, 2002, that the Yucca Mountain site in Nevada be developed as the nation's first long-term geologic repository for high-level radioactive waste.

The following day, President Bush, took the next in a series of steps required for approving the site as a nuclear repository by notifying the Congress that he considers Yucca Mountain qualified for a construction permit application.

The White House Press Release: February 15, 2002

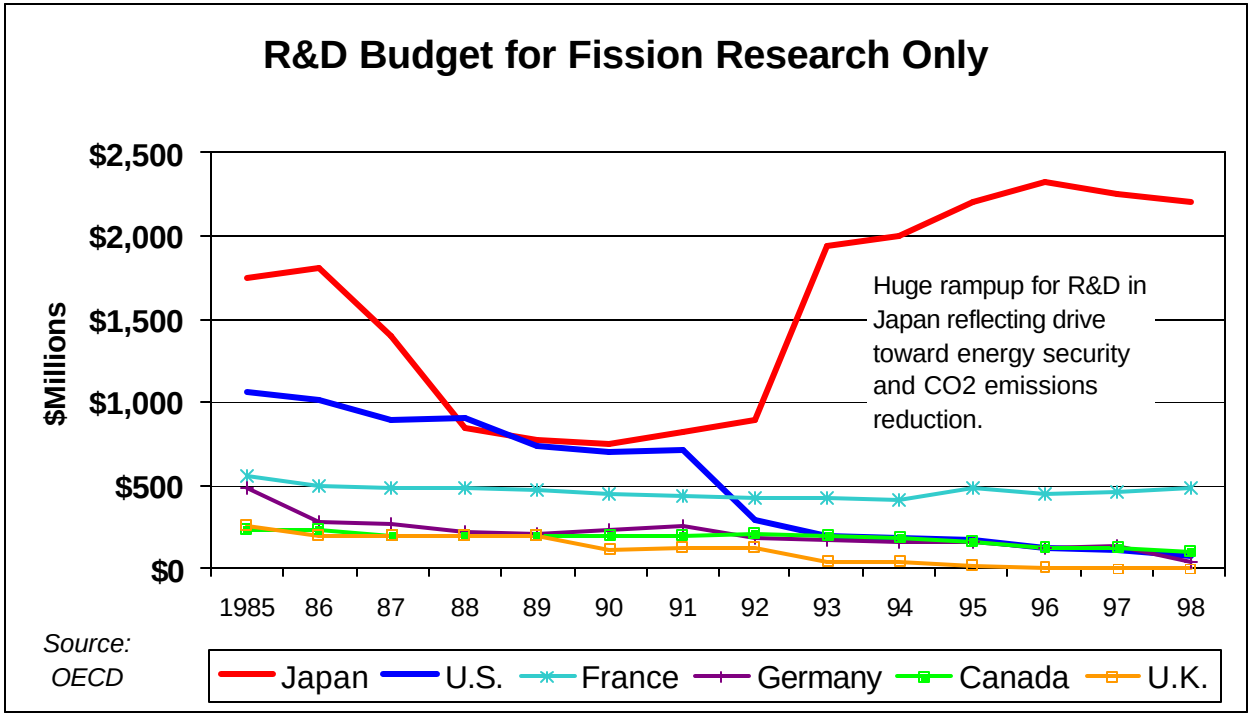
The President today notified the Congress that he considers Yucca Mountain qualified for a construction permit application, taking the next in a series of steps required for approving the site as a nuclear materials repository.

The President's decision to recommend Yucca Mountain is based on sound science. It follows decades of scientific study and a determination by the Secretary of Energy that the site can be safely used to store these materials. He also consulted extensively with his science and environmental advisers to ensure that they concurred with the science, safety, and environmental conclusions of the Secretary's recommendation.

Finding a safe and central repository is not only mandated by law, but it is in America's national security and homeland security interests. Forty percent of our Navy's fleet depends on nuclear power. Currently, nuclear materials are stored in 131 above-ground facilities in 39 states, and 161 million Americans live within 75 miles of these sites. One central site provides more protection for this material than do the existing 131 sites.

Japan, France Lead Global R&D Expenditures for Nuclear Fission

- Worldwide, nuclear fission R&D has declined since the early 1980s from its $5 billion-per-year peak. Funding in OECD countries is about $3 billion a year.
- Japan has taken over the clear lead in spending for nuclear power-related research, and French R&D support has been stable at $500 million per year since 1985.
- Since 1985, Japan has managed 60% of global R&D on the next generation of nuclear reactors, including the GE ABWR, which was recently built by Japanese companies. Japanese companies are pioneering modular construction techniques for nuclear power plants, an important step in accelerating plant construction and reducing cost.
- The United States still leads in R&D, but funding discrepancies jeopardize this lead.



Decline in University Reactors, Student Preparation for Nuclear Engineering

- Since 1980, the U.S. university research reactor base has been halved from 60 reactors to less than 30. This decline threatens the infrastructure for training the next generation of nuclear engineering students.
- At the same time, with no new reactors being built, the outlook is uncertain for nuclear energy careers. Student enrollment at nuclear engineering departments dropped sharply before turning up in 2000, when about 700 students nationwide enrolled in nuclear engineering.